REMARKS

The Amendments

This application was filed with informal drawings including several photographs. The Applicant is now submitting formal drawings in which the photographs have been replaced with line drawings. The specification has been amended to conform the brief descriptions of Figures 2D, 6, 7B, 9, and 10 to the new drawings. No new matter is added by any of the amendments.

The Rejections

Before discussing the rejections and the manner in which the Applicant's claimed radio frequency radiation suppressor is patentable over the references cited by the Examiner, a brief review of the background leading up to the invention will be presented.

The magnetron is a well known vacuum tube electronic device that is used to generate radio-frequency (RF) electromagnetic energy. Magnetrons are in widespread use for microwave cooking, thawing, tempering, drying of materials such as textiles and lumber, and other industrial and laboratory heating processes such as waste remediation and chemical vapor deposition. Ideally, all of the electromagnetic energy generated by the magnetron would be coupled into a waveguide or antenna, or else focused as a directed, collimated beam. However, it is practically inevitable that some of the radiation generated by the magnetron will be transmitted to surrounding areas of the magnetron where it is neither utilized nor wanted. It has proven useful, and often necessary, to reduce this spurious electromagnetic radiation that permeates into the surroundings of an operating magnetron. This leakage radiation can interfere with electronics in the vicinity of the magnetron. Adequate suppression of leakage radiation can be achieved by a device known as an RF suppressor. The RF suppressor is a toroidally shaped element, resembling a collar and made of a material that absorbs

radio-frequency electromagnetic energy. The RF suppressor is mounted on the magnetron and absorbs radiant RF energy, thus avoiding or lessening many of the problems associated with electromagnetic interference from the magnetron.

The known RF suppressor is made of a molded epoxy binder material having iron particles suspended therein. This material is chosen primarily for its excellent RF radiation absorbing properties. There are a number of commercially available RF and microwave absorbing materials, such as, for example, those supplied by the Emerson & Cuming Co. (Randolph, MA) under the trademark ECCOSORB®, that are suitable for the fabrication of RF suppressor components. Material selection can be used to optimize these absorbers for a particular application. The known materials can be molded into various shapes and sizes. After molding the basic shape of the RF suppressor component, the top end is machined with a groove and other features to accommodate mating with the cathode voltage supply connector fixture of the magnetron.

The known RF suppressors are formed in the shape of a collar-like piece. A molded RF suppressor piece is shown in FIG. 5 of the present application and, reproduced below for easy reference. A ridged groove 502 is machined

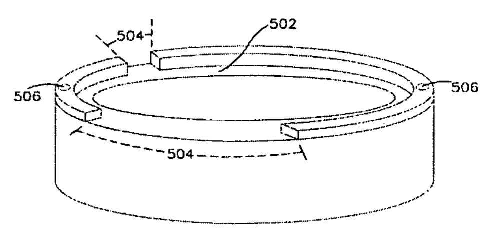

FIG. 5
PRIOR ART

along the top edge, along with two openings 504, so that a annular metal cathode connector fixture may be seated in the groove as shown in FIG. 6 of the present application (also reproduced below), which portrays the molded RF suppressor 602

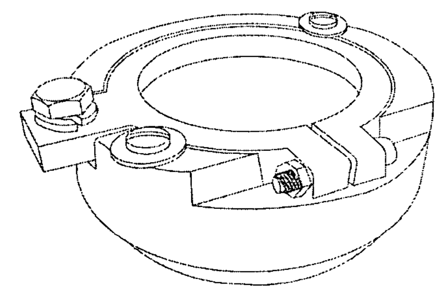

FIG. 6
PRIOR ART

and a brass cathode terminal fixture 604. Referring again to FIG. 5, two screw holes 506 are machined in the molded RF suppressor so that the brass terminal fixture can be fastened to the molded RF suppressor with screws and washers 606, as shown in FIG. 6. The cathode terminal fixture clamps the cylindrical cathode by tightening nut and bolt 608 to make a reliable electrical contact. The cathode bias and filament circuit leads are connected to terminal post 610.

In the known magnetron RF suppressor, the susceptibility to electric field-induced damage has been investigated by the present inventor and prominent failure mechanisms have been identified. The inventor has discovered that in the normal course of operation of a magnetron, a high voltage is imposed between the metal cathode terminal and other electrically grounded metal surfaces, including the anode, casing, cooling tubes, etc. This dc cathode voltage bias sustains the thermionic electron emission current from the cathode to the anode that is necessary for operation of the magnetron. The resulting electric field distribution depends on the geometric

details of the magnetron including the boundary conditions imposed by metal surfaces, and the relative dielectric constants of the component materials. The electric field is supplemented by a radio-frequency electric field caused by the cycloid motion of electrons in the magnetron cavity. Further, when the magnetron is turned on, there is a transient electric field due to overshoot of the power supply used to bias the cathode. The resultant electric field distribution from all of these contributions can be complex, but it is generally true that regions of comparatively high electric field strength occur in the vicinity of the cathode connection to its voltage bias supply. These regions of concentrated electric field strength, when they occur within or near materials with relatively low breakdown-voltage characteristics, cause damage of such materials. The RF suppressor is deployed at a location where the electric field strength is expected to be relatively high and is subject to high electric field breakdown effects.

Once voltage breakdown has been initiated in the RF suppressor material, it contributes to an avalanche effect in which a small electric arc travels through the suppressor and a plasma is formed in the air surrounding the suppressor. The arc enlarges, ionizing the air, and forms a conducting channel that extends from the cathode terminal on the magnetron to a grounded surface in the vicinity of the suppressor that may include the external magnet pole piece, coolant water tubes, or some other grounded structure in the RF shield cabinet where the magnetron is stationed. Although the arc is eventually extinguished when the over-current protection device on the cathode power supply shuts the cathode voltage supply off, significant damage will still have occurred to the suppressor material. Failed suppressors are frequently charred or otherwise burned in an area where the suppressor contacts the high-voltage cathode supply terminal, or else along the inner surface of the suppressor annulus in the vicinity of the magnetron cathode contact. The damage to the RF suppressor will also typically include a punch through characterized by a perforation of the RF suppressor along the radial direction. A hole may be completely burned through the RF suppressor from its

inner surface to its outer surface, or there can be a partial punch-through hole where material is visibly ablated mostly from the outer surface of the RF suppressor.

The damage to the RF suppressor due to cathode supply arcing is almost always irreversible. At a minimum, the damage requires replacement of the RF suppressor part for continued operation of the magnetron. Moreover, the magnetron itself may be damaged. The choke ceramic often sustains severe arcing resulting in a blackened area of several square centimeters in extent. The ceramic-to-metal seal on the magnetron choke may also be damaged to a degree that results in loss of magnetron tube vacuum. When a vacuum tube loses its vacuum seal, it is no longer viable and must be rebuilt at considerable cost. The economic costs associated with RF suppressor failure has made the development of an improved industrial magnetron RF suppressor that is able to withstand the very high electric fields without damage a pressing priority and motivated the development of the invention described and claimed in the present application.

<u>35 USC 102(b): Claims 1-3, 6-8, and 16</u>

The Examiner rejected Claims 1-3, 6-8, and 16 under 35 USC 102(b) as being anticipated by the description of the background of the present invention as set forth in at pages 1-10 and in Figures 1-6 of the present application. Applicant respectfully traverses this rejection for the following reasons.

The Applicant's claimed magnetron RF radiation suppressor as set forth in Claim 1 includes two components. The first component is an inner sleeve member made of an electrical insulating material. The second component is an outer shell assembled to the inner sleeve member. The outer shell member is made of a material that absorbs radio-frequency radiation. As discussed above, the known magnetron RF radiation suppressor is formed in the shape of an annular collar piece as shown in Fig. 5 of the present application. The known RF suppressor is made entirely of a molded

epoxy binder material having iron particles suspended therein. That material is chosen primarily for its excellent RF radiation absorbing properties. As explained above, the known RF magnetron suppressor is subject to damage resulting from very high electric field intensities that can breakdown the RF absorbing material. The inventor has found that such damage can be eliminated by providing electrically insulating inner sleeve member around the inner circumference of an RF absorbing shell. Thus, unlike the known magnetron RF suppressor, the Applicant's claimed RF suppressor is made from two different materials. The outer shell is formed of an EM radiation-absorbing material and functions to suppress the stray RF radiation that emanates from the magnetron. The electrically insulating inner sleeve provides an insulating barrier to resist the arcing that otherwise would cause breakdown and failure of the radiation-absorbing material during high electric field transients. This novel combination of features is neither described nor suggested by any of the text of the present application cited by the Examiner.

The known RF magnetron suppressor is not a two component device. More specifically, it does not include an inner sleeve member that is made of an electrical insulating material. Accordingly, the known RF radiation suppressor as described in the background section of the specification does not anticipate the Applicant's claimed RF suppressor because it does not include every feature of the Applicant's claimed RF suppressor as set forth in Claim 1. It is noted that the Examiner has not indicated what portions of the specification he is relying on to show that the claimed RF suppressor contains each and every feature of the Applicant's claimed RF suppressor. If the Examiner intends to maintain this ground of rejection in the next official action, it is respectfully requested that he clearly indicate what text and drawing figure he is relying on so that the Applicant will have an opportunity to consider the alleged disclosure and respond accordingly.

It is well settled that in order for a reference to anticipate a claimed invention, it must describe every element of the claimed invention. MPEP §2131. The background section (pages 1-10) of the present application does not describe a RF radiation suppressor for a magnetron that has the combination features set forth in Claim 1. Accordingly, the alleged "admitted prior art" relied on by the Examiner fails to raise a *prima facie* case of anticipation.

Claims 2, 3, and 6-8 depend from Claim 1 either directly or indirectly and thus, include all of the features of Claim 1. Therefore, Claims 2, 3, and 6-8 are novel for at least the same reasons as Claim 1.

The Applicant's claimed RF radiation suppressor for a magnetron as set forth in Claim 16 includes three components. The first component is an inner sleeve member made of an electrical insulating material. The second component is an outer shell assembled to the inner sleeve member in which the outer shell member is made of a material that absorbs radio-frequency radiation. The third component is a metallic connector attached to the inner sleeve member. Thus, the Applicant's claimed RF radiation suppressor for a magnetron as set forth in Claim 16 has both of the components set forth in Claim 1. Therefore, Claim 16 is novel for at least the same reasons discussed above for Claim 1.

For all of these reasons, the rejection of Claims 1-3, 6-8, and 16 under 35 USC 102(b) is improper because it is not supported by substantial evidence of unpatentability. The rejection should be withdrawn.

<u>35 USC 103(a): Claims 5 and 19</u>

The Examiner rejected Claims 5 and 19 under 35 USC 103(a) as being unpatentable over the RF suppressor for a magnetron as described in the background

section of the present application in view of US 6,225,876 (Akino et al.). In making the rejection the Examiner stated: "The admitted prior art discloses a magnetron suppressor but fails to show metal particles suspended in binder. Akino discloses a feed-through EMI filter with a metal-flake composite material that shows a metal dispersed in a binder material. It would have been obvious to one of ordinary skill to use a suspended metal so as to produce a shielding effect." The Applicant traverses this rejection for the following reasons.

As discussed above relative to Claims 1 and 16, the Applicant's claimed RF radiation suppressor includes two components: an inner sleeve member made of an electrical insulating material and an outer shell assembled to the inner sleeve member. The outer shell member is made of a material that absorbs radio-frequency radiation. The background section of the present application does not describe that combination of features. The known magnetron RF suppressor has a collar-like structure that is formed exclusively of a material that absorbs RF radiation. It does not include an inner sleeve member that is made of an electrical insulating material.

Akino et al. does not does not describe or suggest the use of an electrical insulation sleeve member that could be assembled to the known magnetron RF suppressor. The Examiner's proposed combination would not teach all of the features of the Applicant's claimed RF suppressor as set forth in Claims 1 and 16. Therefore, the proposed combination cannot anticipate the Applicant's claimed RF suppressor as set forth in either Claim 5 which depends from Claim 1 or as set forth in Claim 19 which depends from Claim 16. Accordingly, the combination of references relied on by the Examiner fails to raise a *prima facie* case of unpatentability relative to Claims 5 and 19.

For all of these reasons, the rejection of Claims 5 and 19 under 35 USC 103(a) is improper because it is not supported by substantial evidence of unpatentability. The rejection should be withdrawn.

CONCLUSION

For all of the foregoing reasons, it is believed that all of the claims of this application are in condition for allowance. Accordingly, the Applicant respectfully requests that the Examiner reconsider the claims in the light of the foregoing remarks.

Respectfully submitted,

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Enclosures: Drawing Replacement Sheets

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Please amend the Drawings as follows.

Replace the several drawing sheets with the Replacement sheets submitted herewith.